

NASA TECH BRIEF

Marshall Space Flight Center



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Accumulative Weights Program

The problem:

To provide weight accumulation output data for structural, dynamic, and load analyses of the Saturn V vehicle.

The solution:

A computer program which provides the capability of assessing weight above given structural station planes for inert and variable masses for any selected loading condition.

How it's done:

The Accumulative Weights Program produces an output that yields weights data concentrated on and/or cantilevered from desired stations along the vertical axis of the Saturn V vehicle. Presently, input data availability limits the program's function to vertical structures only.

The program input consists of three essential data sets: (1) inert weight; (2) variable weight; and (3) control weight.

The inert weights data include only those items which comprise the structure being studied, and are stored on a data tape to be read into the program. The tape contains the mass properties of each item (weight, center of gravity locations, moments of inertia), as well as data to indicate whether or not the item is cantilevered, the projection of the item in the vertical plane (DL), and the distance from the bottom of the item to its vertical center of gravity (Db).

Variable weights data are input on cards as mass vs. time, and are analyzed within the program to obtain the physical projections and mass characteristics which correspond to the information described above for inert items. The present Saturn

V oriented analysis uses only six different variable mass (propellant) containers, and can be evaluated for any flight loading time.

Control data are also input on cards, and control the process of the program, defining the station planes, flight loading times, and structural configurations to be studied.

The program analysis begins with the most forward selected plane, accumulating all weights forward of that plane, and distributing weights for those items whose geometries locate them both forward and aft of the plane and items which may be intersected by more than one selected plane. This weight distribution is accomplished using a ratio of Db:DL to select a series of equations which will most nearly simulate the true geometry of the item for accumulation at the selected station planes. For cantilevered items, which may be physically located forward and aft of a plane, the masses are concentrated at the attachment or reaction points on the mainline structure.

Two weight values are obtained for each plane. The first is the weight of all items above the selected plane (excluding cantilevered weights); the second is a weight accumulation of the first value plus all items cantilevered at the chosen plane.

The structure is evaluated in an aft direction, accumulating weights until the last selected station plane reflects the mass of the complete structural configuration. Accumulative weights of successive loading conditions retain the same inert weight distribution and accumulate the re-evaluated variable weights.

(continued overleaf)

Notes:

1. The program is adaptable to any industry requiring load bearing studies in structures such as buildings, ships, towers, bridges, aircraft, etc. It could be used in preliminary development studies to optimize ratios of stress and load bearing to weight, as well as for final analysis in structure performance studies.
2. The program is written in FORTRAN IV for use on the IBM 360.
3. Requests for further information may be directed to:

COSMIC
Barrow Hall
University of Georgia
Athens, Georgia 30601
Reference: B71-10181

Patent status:

No patent action is contemplated by NASA.

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